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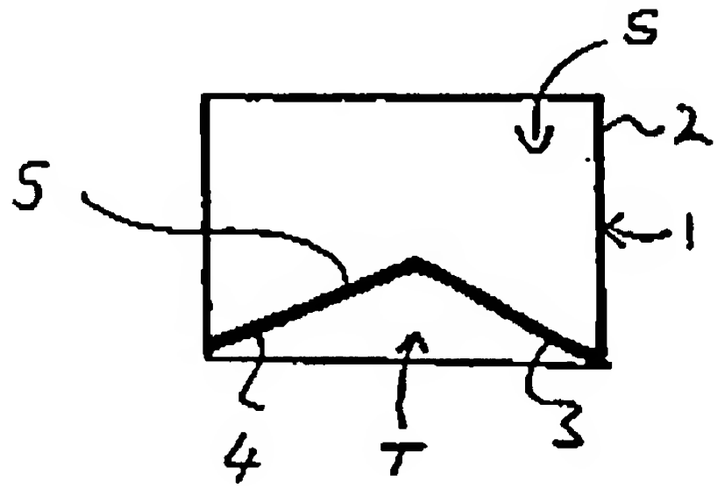

(57) Abstract

This invention relates to a method of manufacturing a contact lens which has a first section formed from a first material and a second section formed from a second material. The method includes the use of a casting mould (1) which has an end wall (3) that is inwardly displaced into the space defined within the mould to define a receptive well (S, T) into which material can be cast to be cured/polymerised to form a lens button (B). The method further includes: casting a first monomer material into the receptive well of the casting mould and polymerising/curing the monomer material; and machining the article formed by the above casting into a contact lens (CL) wherein the first monomer material includes a polymerisable material which has a penetrating-like action with respect to the material from which the casting mould is formed that acts to bond the mould and the cured/

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A METHOD OF MANUFACTURING A CONTACT LENS

Background of the Invention

Field of the Invention

This invention relates to a method of manufacturing a contact lens, and, in particular, to a method of manufacturing a contact lens from two or more differing materials, for example a composite lens, bifocal or trifocal lens.

State of the Art

Normally these contact lenses when formed from two or more materials are formed with a first member formed from a first material and a second member formed from a second material. In one particular example of this, a composite lens which is generically known as "Saturn" in the industry, the first member comprises the optical zone of the lenses and is normally made from a "hard" material such as a rigid gas permeable (RGP) material, and the second member comprises a skirt around the optical zone and is normally made from a "soft" material, such as a hydrogel material. At present composite lenses of the general type described above are manufactured from buttons that are formed by the following process steps:

(a) forming a first rod of material by polymerisation of a first monomer material;

(b) forming a layer of a second material about said first rod of material by polymerisation; and

(c) transversely slicing the rod so formed into buttons.

The problems associated with the above-mentioned manufacturing technique for the button include:

(a) The first rod of material must be located centrally within the finished buttons. With the procedures employed in the industry this is not so easily achieved, and consequently there is considerable scope for error from this aspect, leading to a high rejection level of rods and buttons.

(b) The actual diameter of the first rod of material provides the dimensions of a significant characteristic of the finished lens. Therefore the first rod of material has to have a uniform diameter.

(c) The adhesion between the two materials of the two members as a result of the different character of the materials of the composite lens may be very low, and when this is combined with the fact that the soft contact lens material will be swollen after manufacture and prior to use, thus exerting a considerable force on this adhesion, the problems can be significant.

The net result of the above is that the production of composite contact lenses using buttons in accordance with the above-detailed method is expensive and results in a high rejection rate of rods, buttons and lenses.

The situations and problems above have been discussed with regard to one particular example, namely a "Saturn" lens. It should, however, be noted that the situation and problems are very similar to those that would be encountered for the production of bifocal and other multifocal lenses from two or more different polymeric materials.

Summary of the Invention

The present invention is concerned with providing a method of manufacturing contact lenses, for example composite contact lenses or

multifocal contact lenses, in which the above-discussed problems have at least been alleviated or reduced significantly.

In accordance with the present invention in its broadest scope, there is disclosed a method of manufacturing a contact lens which has a first section formed from a first material and a second section formed from a second material, which contact lens is manufactured by using a casting mould of generally cylindrical construction and having a side wall and an end wall, which end wall has an inward displacement into the space defined by the side wall, which space defined by the side wall and end wall is a receptive well into which material can be cast to be cured/polymerised, which method comprises:

casting a first monomer material into the receptive well of the casting mould, and polymerising/curing the monomer material; and

machining the article formed by the above casting into a contact lens;

wherein the first monomer material includes a polymerisable material which has a penetrating-like action with respect to the material from which the end wall of the casting mould is formed.

The casting moulds for use in the method of manufacture of the present invention can be mass produced from suitable contact lens materials relatively cheaply and with a high degree of accuracy. For example, the moulds may be produced by moulding the material in a polystyrene mould, the polystyrene mould itself being injection moulded at a very low cost.

From this it will be readily understood by those in the industry that contact lenses which are made from two or more different materials can

be made by the method in accordance with the present invention cheaply and easily, as the problems of the currently known process are significantly alleviated if not eliminated altogether.

In one arrangement of the present invention, the inward displacement of the end wall of the casting mould is a solid projection, the material of which forms one of the sections of the contact lens.

Alternatively, the inward displacement of the end wall of the casting mould may define a second receptive well into which a second monomer material may be cast and subsequently polymerised/cured prior to machining.

In accordance with a second aspect of the present invention, a method of manufacturing a contact lens which has a first section formed from a first material and a second section formed from a second material, which contact lens is manufactured by using a casting mould of cylindrical construction and having a side wall and an end wall, which end wall has an inward displacement into a space defined by the side wall so that the casting mould has two receptive wells for the casting of material to be cured/polymerised which are separated from one another by the end wall of the casting mould, which method comprises:

casting a first monomer material into one of the receptive wells of the casting mould and polymerising/curing the monomer material;

casting a second monomer material into the other receptive well of the casting mould and polymerising/curing the monomer material; and

machining the article formed by the above castings into a contact lens;

wherein the first and second monomer materials include a polymerisable material which has a penetrating-like action with respect to the material from which the end wall of the casting mould is formed.

The inclusion in the first and second monomer materials of a polymerisable material with a penetrating-like action with respect to the material of the end wall of the casting mould means that the polymerisable material softens, swells and/or dissolves the surface material of the end wall of the casting mould, and upon polymerisation a very strong bonded interface is produced between the monomer material cast and the end wall of the casting mould. In fact, the bond strength of a button made in accordance with the present invention is significantly increased over that which would be present should the two materials have been placed in direct bonding contact.

When both of the casting operations have been completed a button is formed which includes the end wall of the casting mould sandwiched between the two bodies of polymerised first and second monomer material, each of the bodies of polymerised first and second monomer material being strongly bonded to the respective surface of the end wall of the casting mould, as discussed in the paragraph above.

The incorporation of the casting mould, or a part thereof, into the button means that the method in accordance with the present invention utilises a simple one- or two-stage cast moulding operation which is significantly cheaper to operate than the presently used method.

The accuracy of the alignment of the two materials, centre and